

## **ENVIRONMENTALLY CHALLENGED**

### **SCENARIO DESCRIPTION/DIMENSIONS/DRIVERS**

The EC world is one where strict limitations are placed on carbon dioxide CO<sub>2</sub> emissions worldwide because of conclusive evidence showing their harm to the planet. Limitations and concerns are strongest in the developed world, and recognition of the CO<sub>2</sub> problem came soonest in Europe. The United States with high per capita energy consumption and emissions is at a distinct disadvantage. The developing countries, while accepting that CO<sub>2</sub> emissions are a problem, place most of the blame on the industrialized world; and are reluctant to limit emissions if it hampers economic development and growth. Some developing countries seek to circumvent or evade emissions limitations. There is a system of caps on CO<sub>2</sub> emissions for each country, enforced by international organizations. In the U.S. there is a system of tradable pollution rights and very high taxes on carbon based fuels.

The U.S. is a weak competitor in the EC world because of its high reliance on energy intensive industries. Its land area requires a large use of transportation and makes the U.S. more energy intensive. Because of high fuel prices, there is low growth in the demand for aerospace products and services. The developed world (especially Europe, the U.S. and Japan), in attempts to force compliance with the CO<sub>2</sub> emission limits, imposes trade and other sanctions on non-compliant countries. In turn, this raises tensions among have and have not countries with threats to global security. The strong needs to reduce and stop damage to the environment has captured the public eye in the developed world. There are sporadic terrorist threats to as well as attacks on intensive users of carbon fuels, such as air transportation. The weak U.S. economy exacerbates domestic tensions with parts of the population looking to technology as a potential solution, while others view technology as the root cause of the problem. Governments worldwide, in response to the strong public concerns about environmental catastrophe, now take a very active role by establishing systems to control CO<sub>2</sub> emissions through regulation and taxes. In addition, the U.S. government is actively pursuing solutions to the CO<sub>2</sub> problem. The worldwide regulatory regime for CO<sub>2</sub> is highly balkanized, as countries progress at different rates and seek different solutions. The developed world also begins active monitoring programs of emissions in all countries to detect cheaters and sanction non-compliant countries.

The prices for all modes of transportation are high because of high taxes on carbon fuels. In an attempt to reduce fuel consumption, airlines are shifting to less frequent service with larger aircraft and higher load factors. Aircraft are now operated at speeds to achieve minimum fuel consumption. Business and pleasure travel are both reduced in response to the higher prices of transportation. Firms also seek to reduce the energy input of producing goods and services by revamping production processes and reducing use of transportation for people and goods. Automobile and train manufacturers shift to alternate fuels with low or no emissions.

## **THE AERONAUTICS INDUSTRY IN THE EC WORLD**

The aerospace industry, facing much lower demand for its products, becomes increasingly concentrated as firms merge. Distinct markets evolve for retrofit technology to reduce fuel consumption and emissions of the existing civil aircraft fleet. The U.S. aerospace industry is lagging because it was late to increase energy efficiency and reduce emissions in both its production processes and product offerings. There is a market demand for improved air traffic management to reduce fuel consumption as well as for sensors to detect pollution. U.S. firms are especially trying to exploit foreign markets where economic growth is stronger. However, they are increasingly forced to pursue alliances with foreign companies to gain entry to these foreign markets. In addition, U.S. companies often only have technology to bring to the table because of the shortage and cost of investment capital in the U.S.

The military aerospace market is also one of low growth in the U.S., but there is heightened demand for monitoring and counter terrorism systems, including sensors, satellites, remotely piloted vehicles and UAVs. There also is a growing demand for micro-vehicles and systems which operate with extremely low fuel consumption. The U.S. military has taken the role of monitoring other countries for security, environmental compliance and economic reasons.

## **FUTURE NEEDS AND OPPORTUNITIES**

In the EC world, air transportation and the aerospace industry are particularly challenged because of their energy intensity; fuel costs are high and there are financial incentives to reduce emissions. In the EC world there are the following core technology needs:

- Low or zero CO<sub>2</sub> emissions aircraft
- The ability to place sensors rapidly and at low cost
- Sensors to monitor emissions outputs by other countries
- ATM improvements to reduce fuel consumption
- Improvements to the security of civil aircraft

The technological implications and R&D needed to satisfy these needs are discussed in the following subsections.